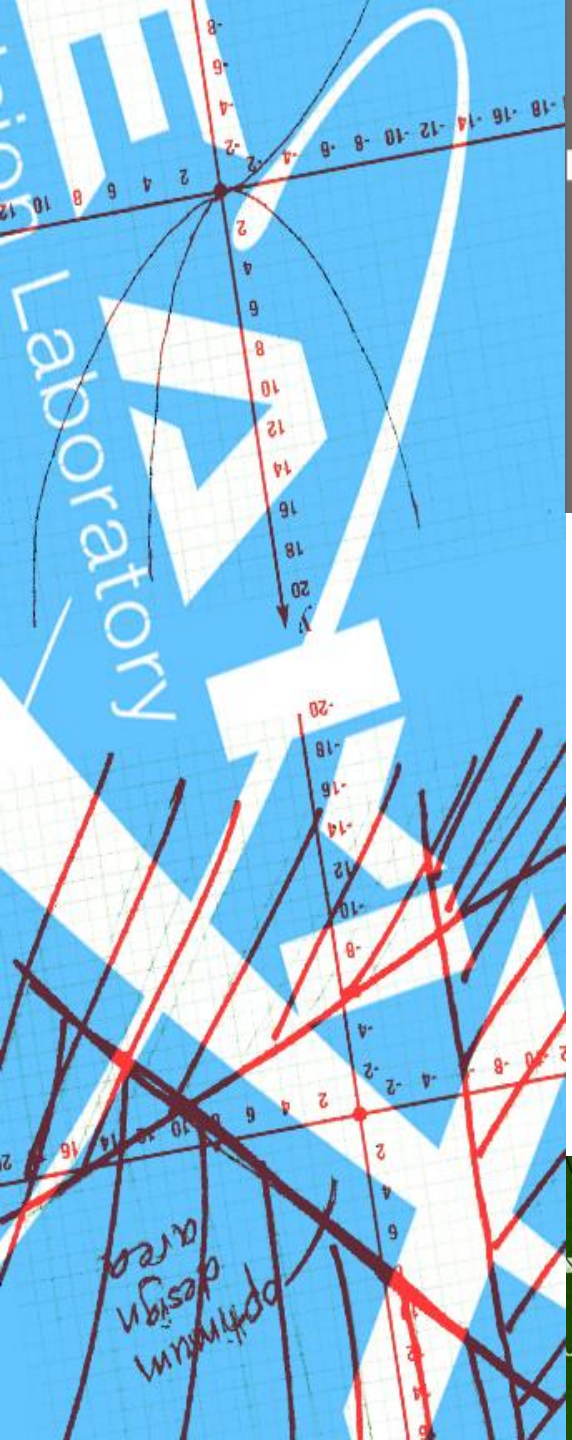
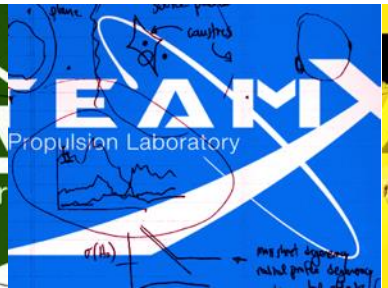


TEAMX

Kelley Case
Concept Design Methods Manager
Jet Propulsion Laboratory
California Institute of Technology

Airbus CDF Workshop
October 19-20, 2017

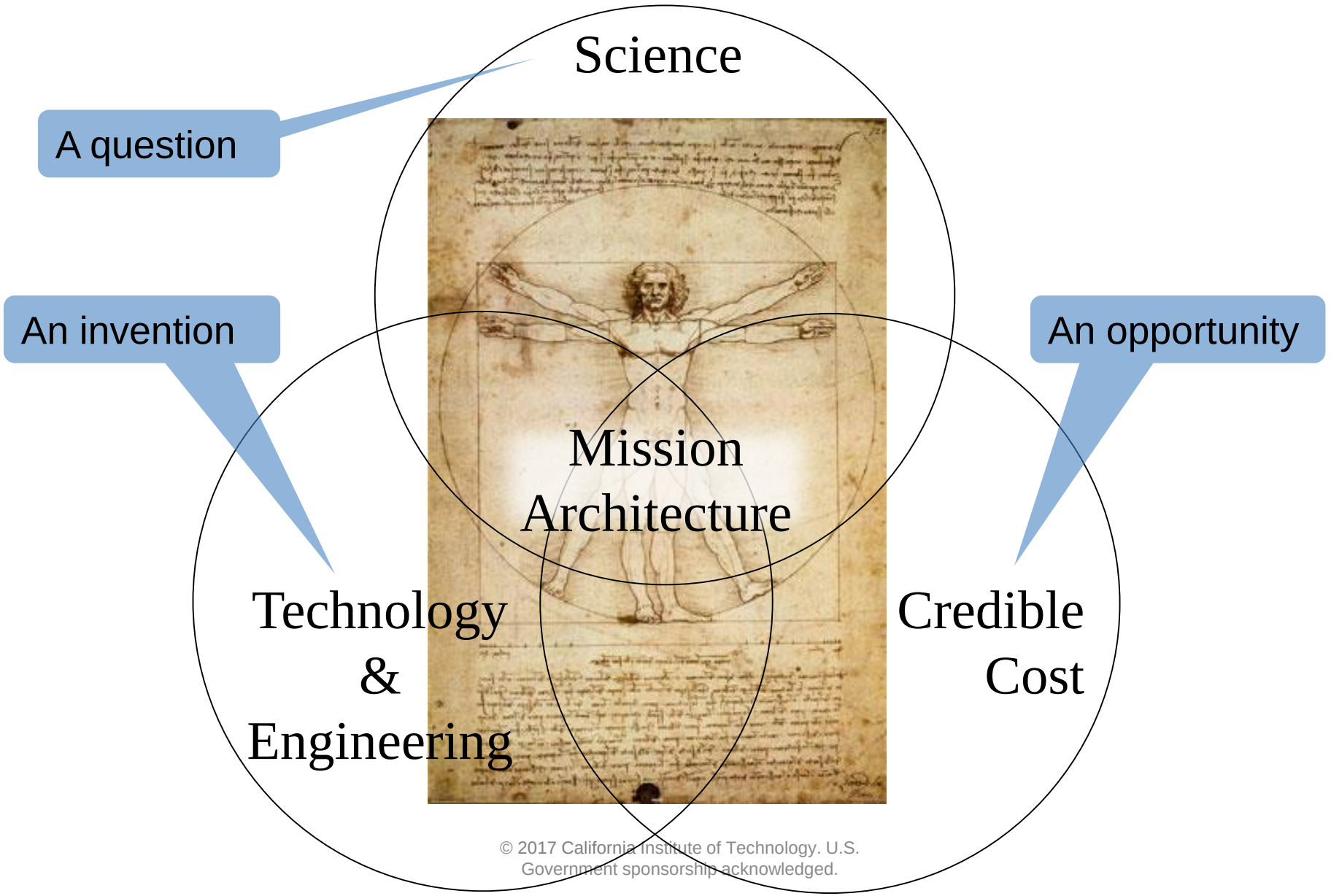


Agenda

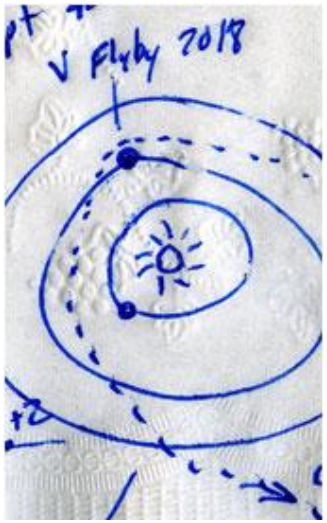
- How do we formulate missions in Team X?
  - Questions & Answers
- What is the Business Model of Team X?
  - Questions & Answers
- What is the Study Process of Team X?
  - Questions & Answers

How do we formulate missions in

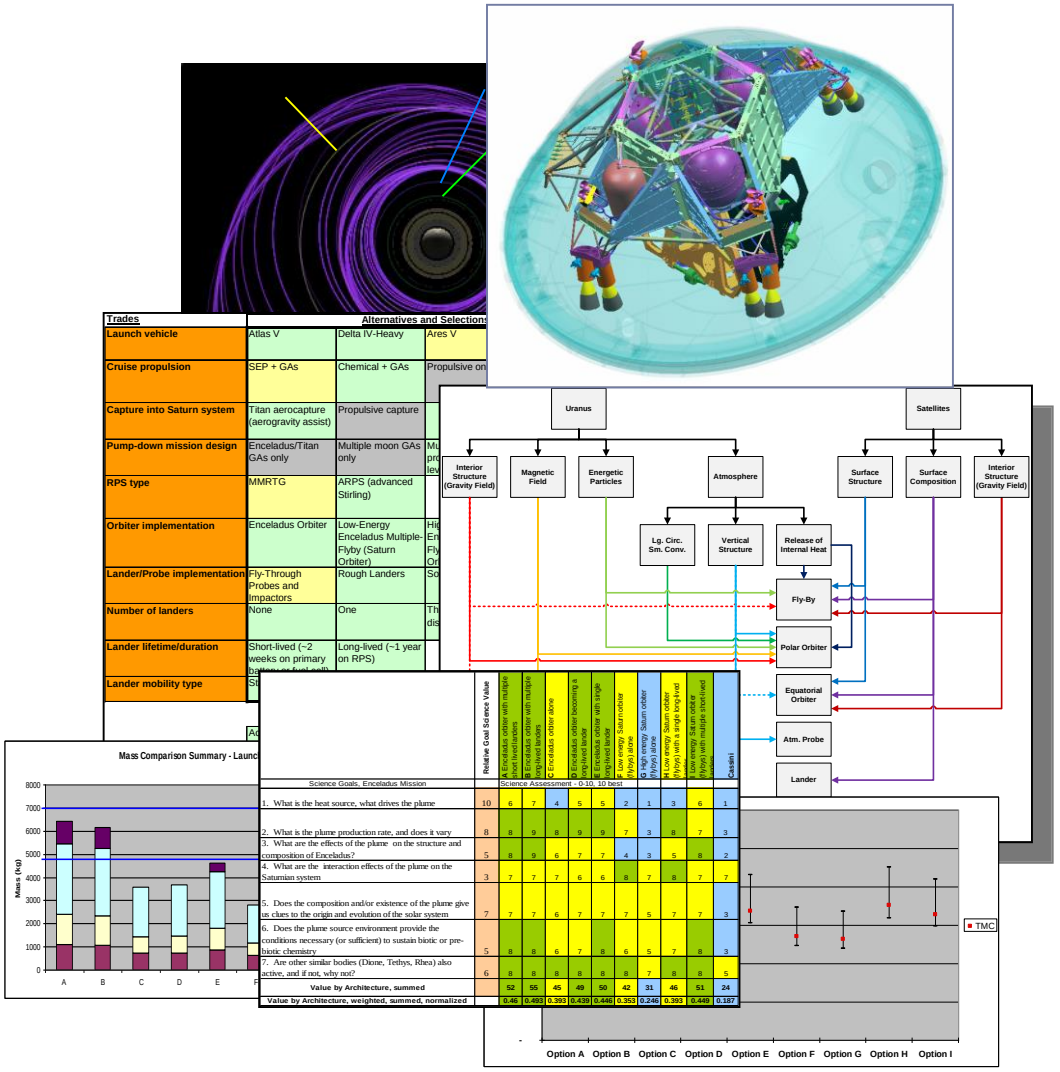
Every mission starts with a spark



…then the concept is developed



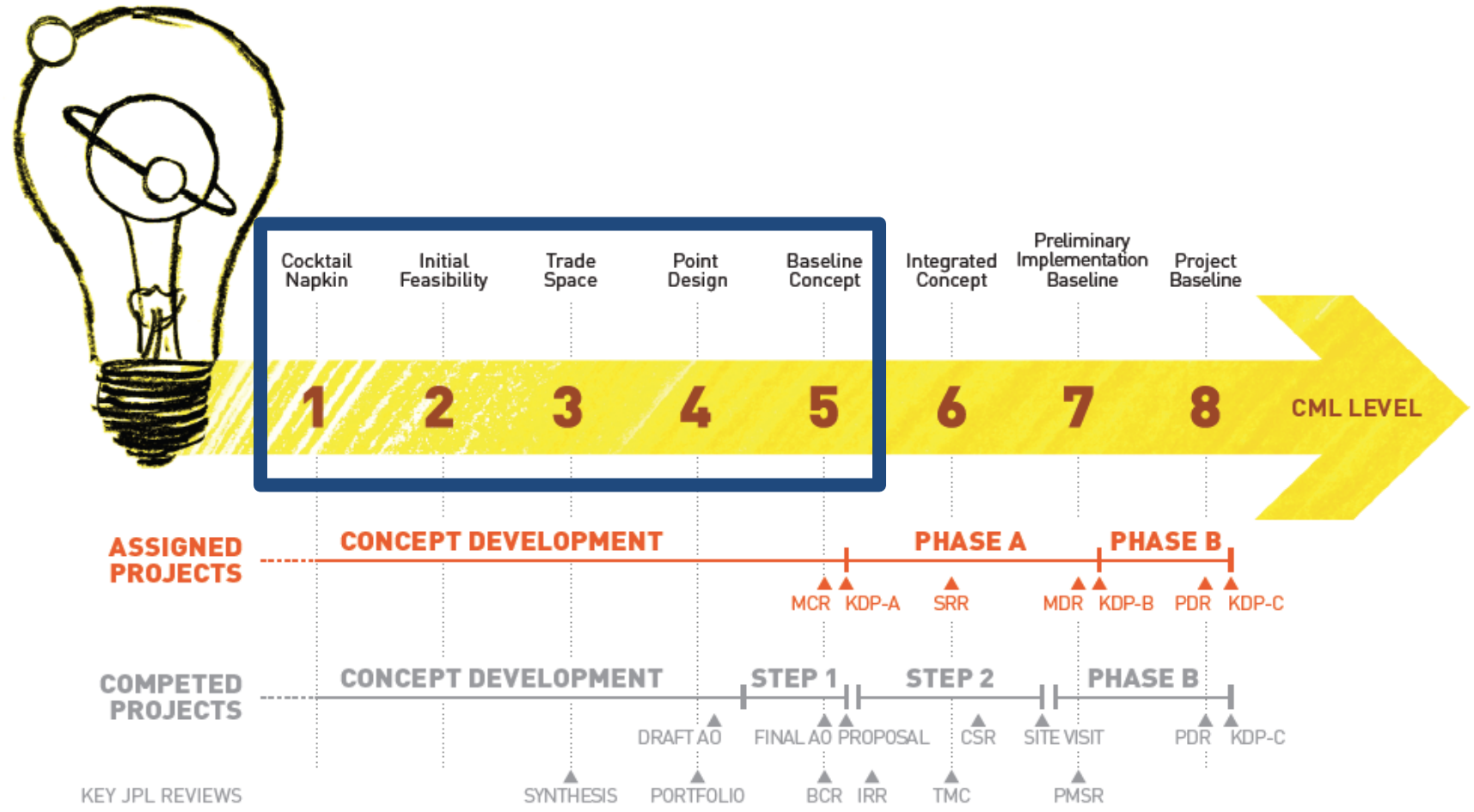
or



Idea?

Formulation Life Cycle Milestones to Implementation

JPL Innovation Foundry



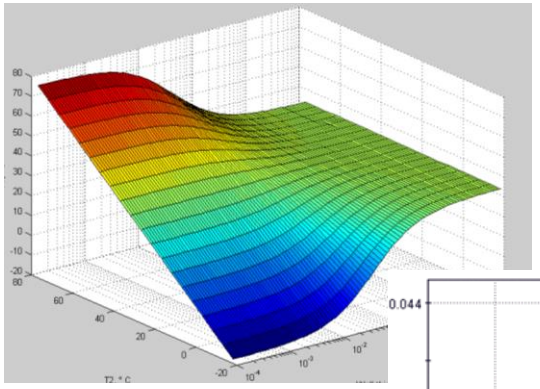
CML 1: Idea Generation

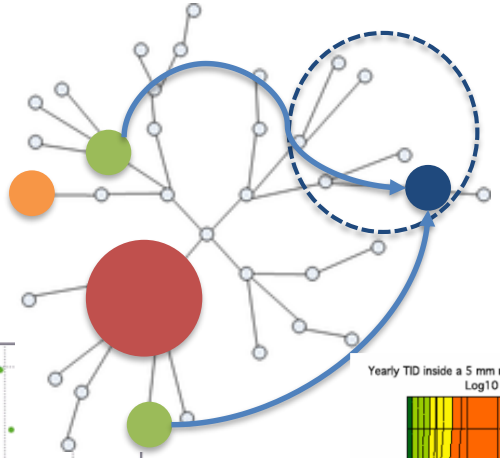
Ideate 100+ ideas from a single question or topic

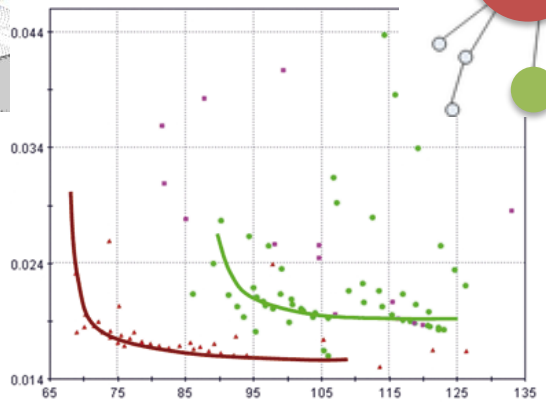
Organize and rank ideas based on figures of merit

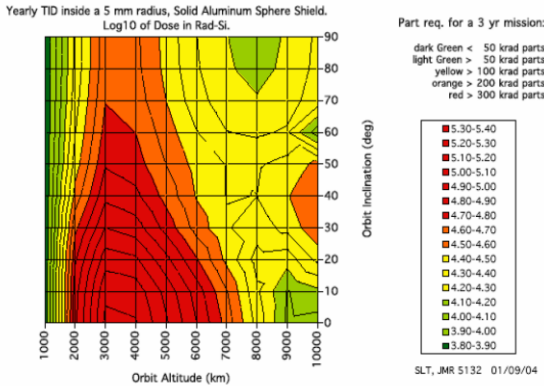
CML 2: Initial Feasibility

Quantitatively examine an idea or set of ideas for both technical and programmatic feasibility using advanced analysis tools









CML 3: Trade Space Exploration

Efficiently explore the value, cost, and risk trade space for concepts and new processes

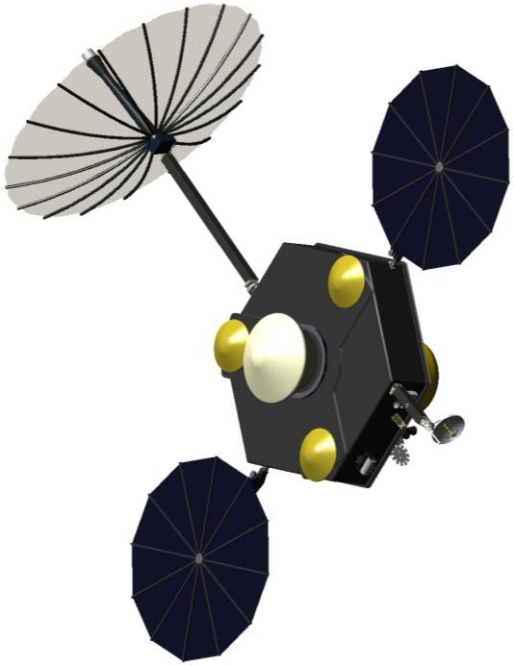
Phoenix Lander
May 25, 2008

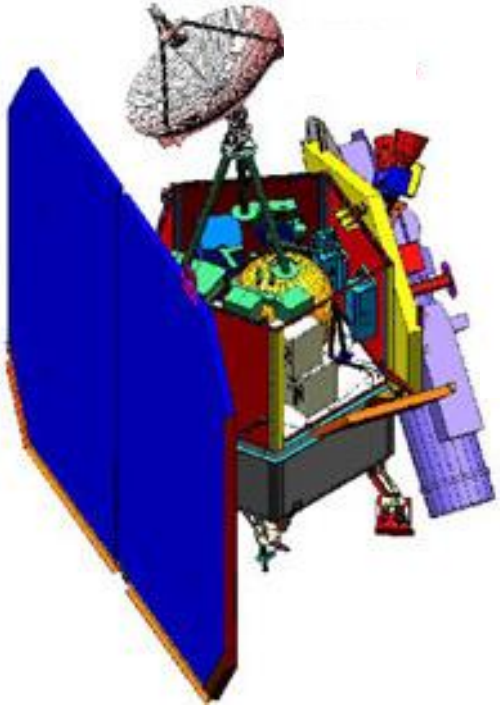
Curiosity selfie Oct 6, 2015

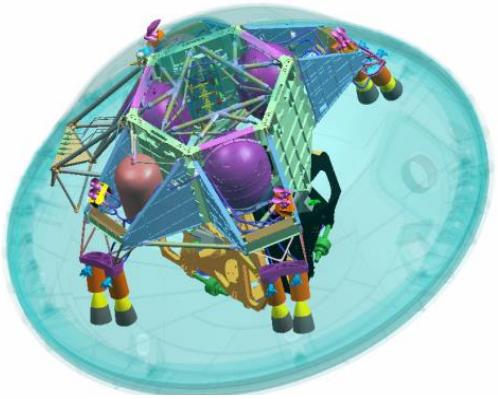
Mars Helicopter
Artist rendering

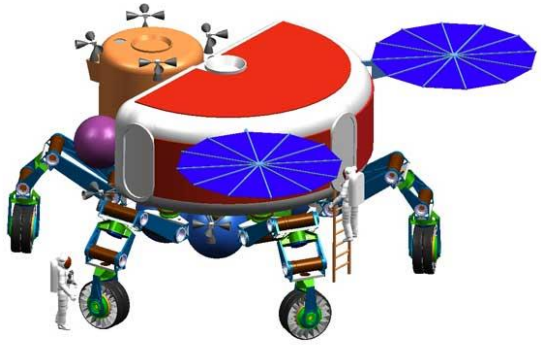
CML 4: Point Design

Point Design at the component level, backed by validated, institutionally supported, integrated models, and staffed by the “doing” organizations



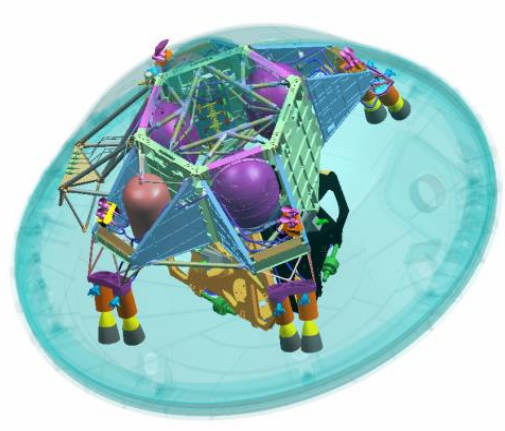


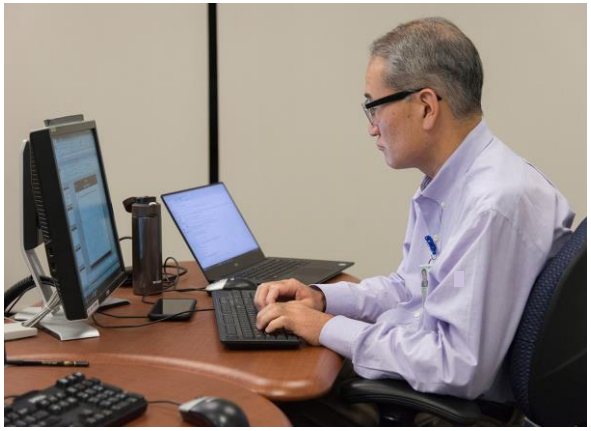




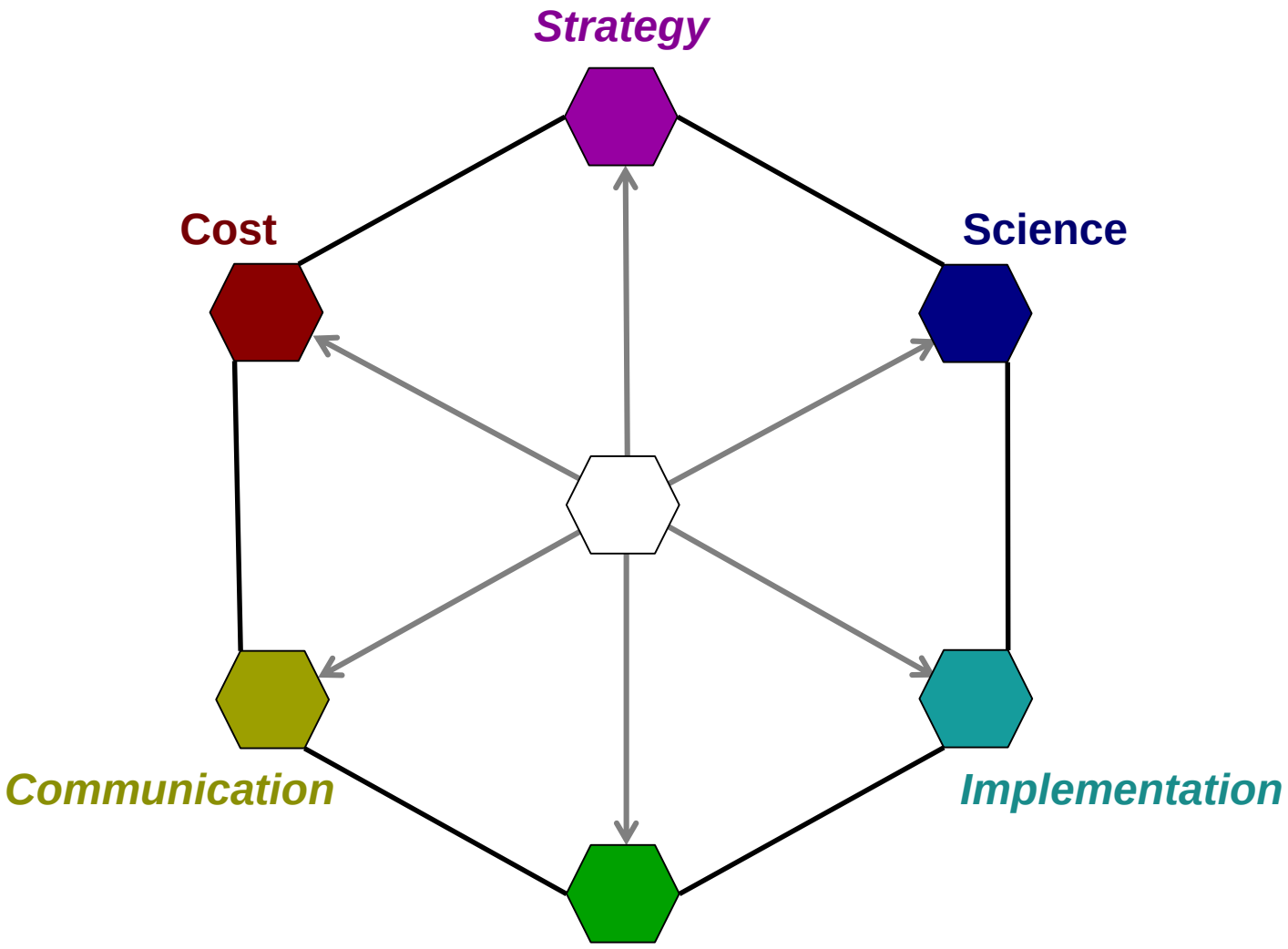
CML 5: Baseline Concept

Point Design baseline is “frozen”, such that it is a stable design; and can be reviewed for technical and programmatic details by institutionally approved staff from the “doing” organizations

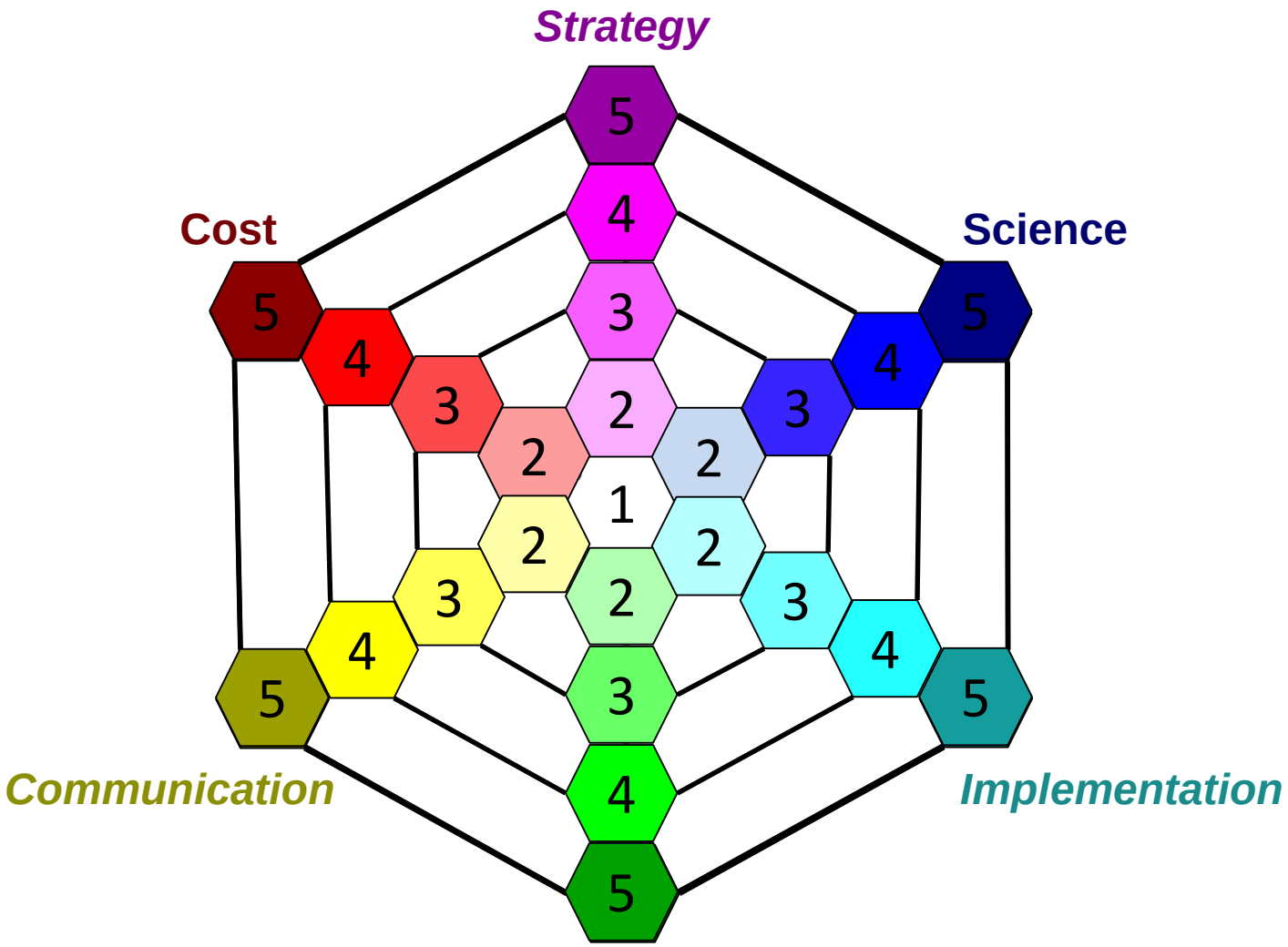




The Six Dimensions of Mission Formulation

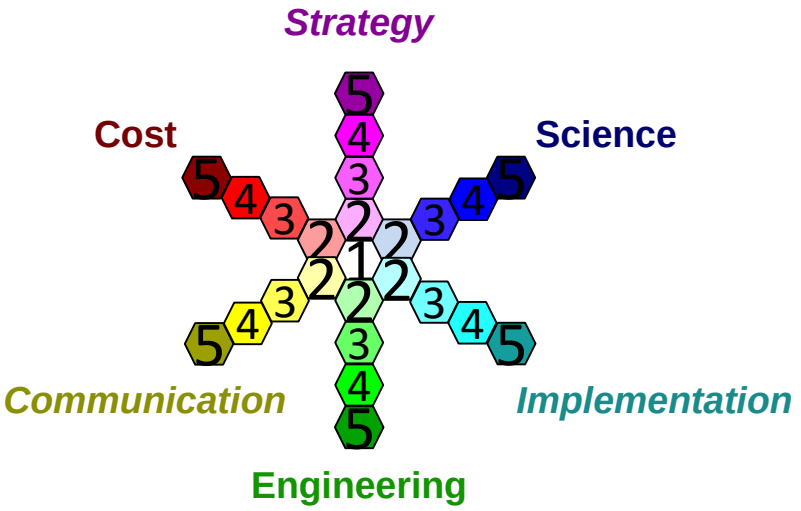


Mature Concept to be Self-Consistent in All Dimensions



Concept Maturity Level Summary

- Concepts need to be ***STRATEGICALLY*** matured in ALL dimensions of the hexagon
- Each concept team has unique challenges to overcome in different dimensions
- Independent assessment will identify teams' blind spots
- Early identification of challenging areas will help teams focus on solving the *right* problems

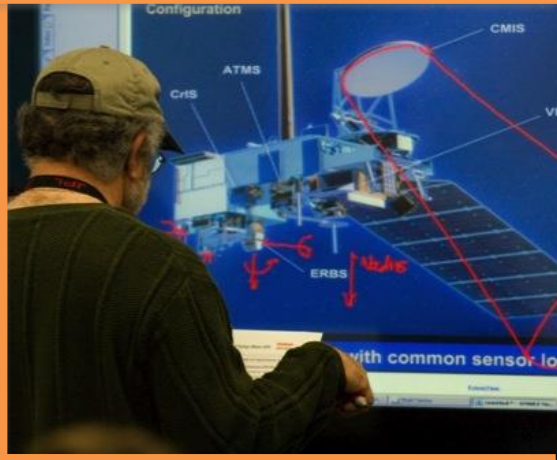


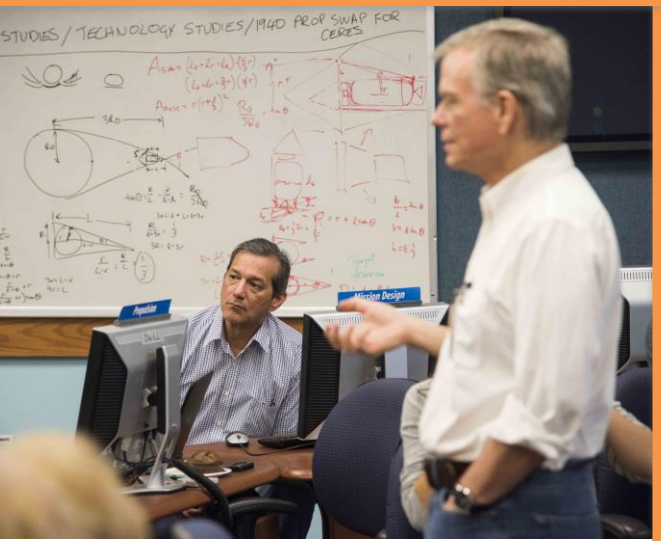
Concept Maturity Levels are used as a "Rosetta Stone" to understand client needs


active
corpus
callosun


Concept for an outerplanet
Mass= 940KG
Pwr:MMRTG

Questions?

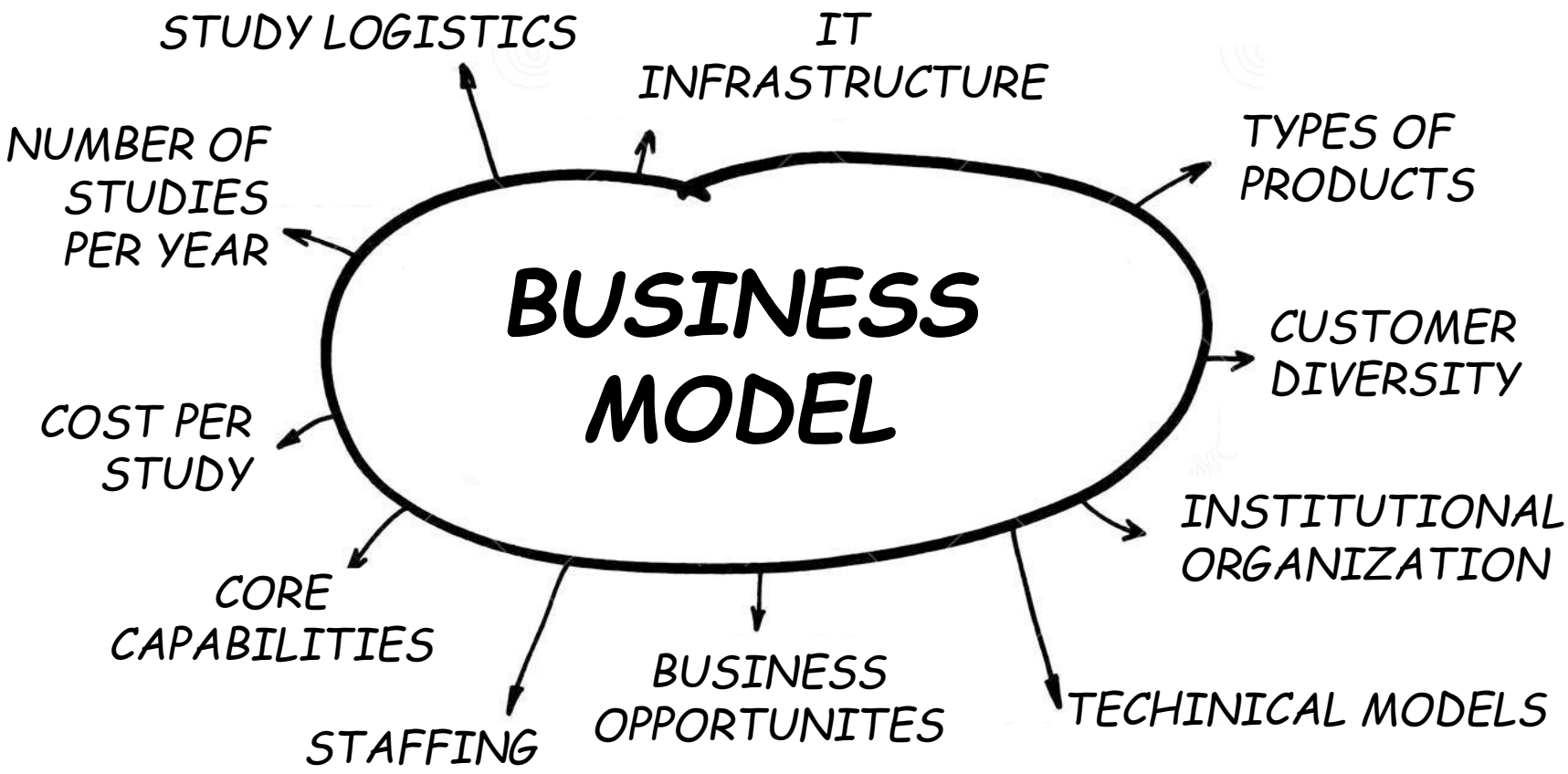

Configuration
CMIS
ATMS
CrIS
ERBS


STUDIES / TECHNOLOGY STUDIES/1940 PROP SWAP FOR CERES


N
Team X Operations Manager
Storage
Instrument Study Team Area C
Architecture Study Team Area B
Storage
System Administrators
Mission Study Team Area A
Storage

What is the Business Model of

Understanding Your Concurrent Engineering Business Model

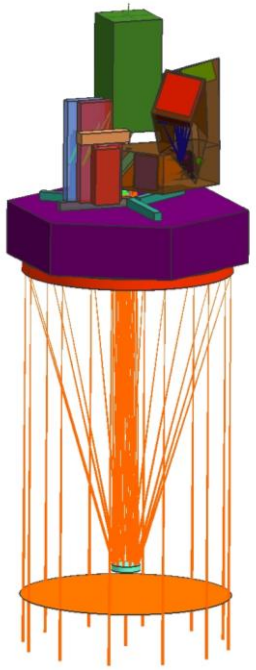


JPL Concurrent Engineering Study Teams

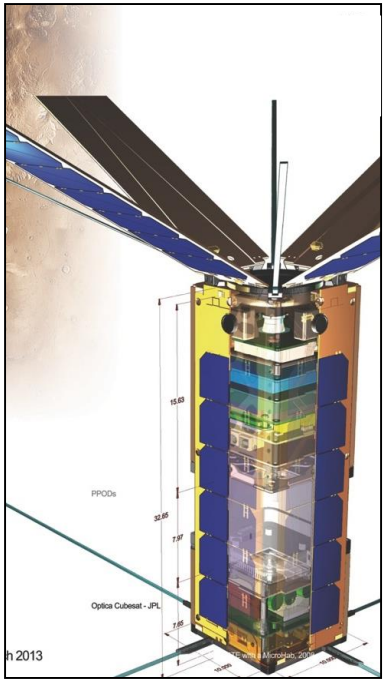
Four unique teams respond to study demands:

A-Team (Architecture)

Team X

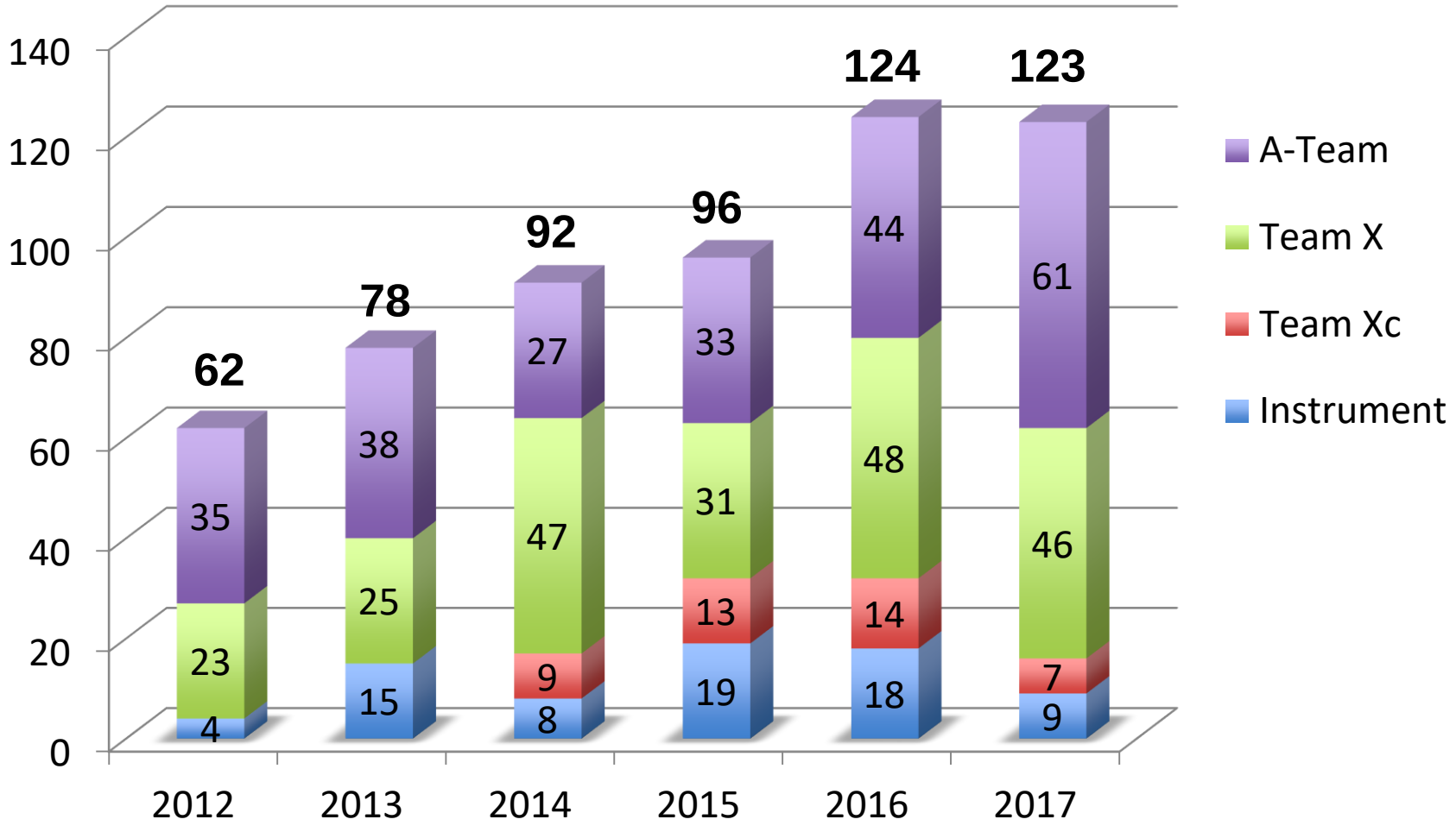


Team X Instruments



Team Xc (CubeSats and SmallSats)

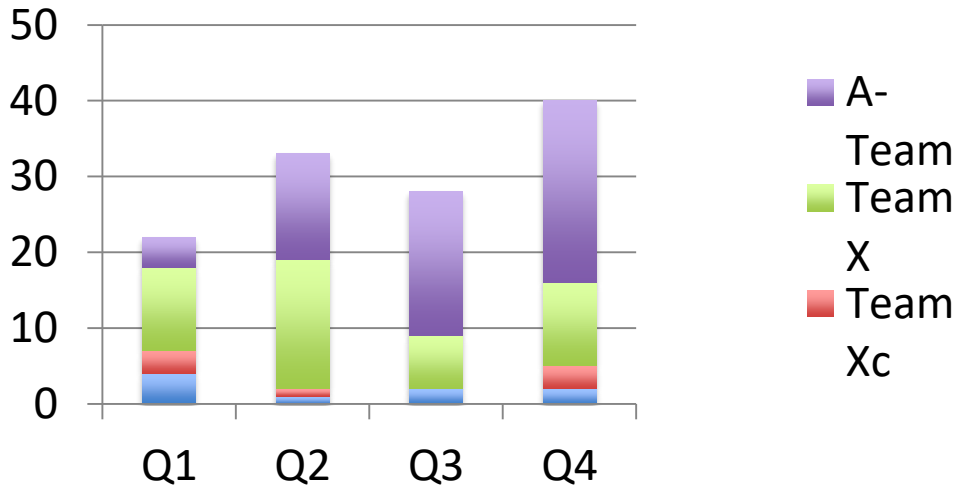
JPL Concept Study Metrics



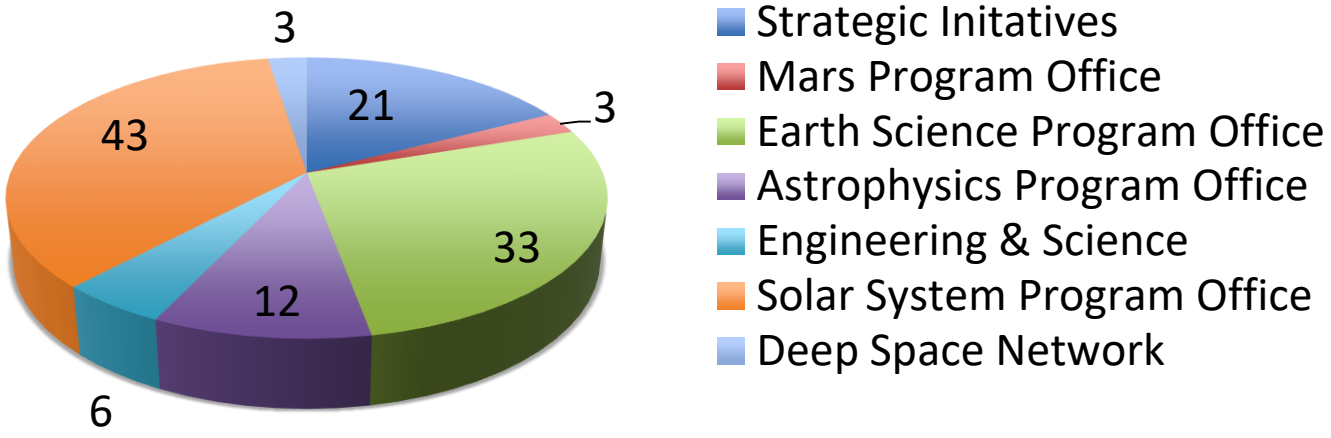
Fiscal Year 2017 Study Metrics

123 Total Studies

- 61 A-Team
- 46 Mission
- 9 Instrument
- 7 CubeSat

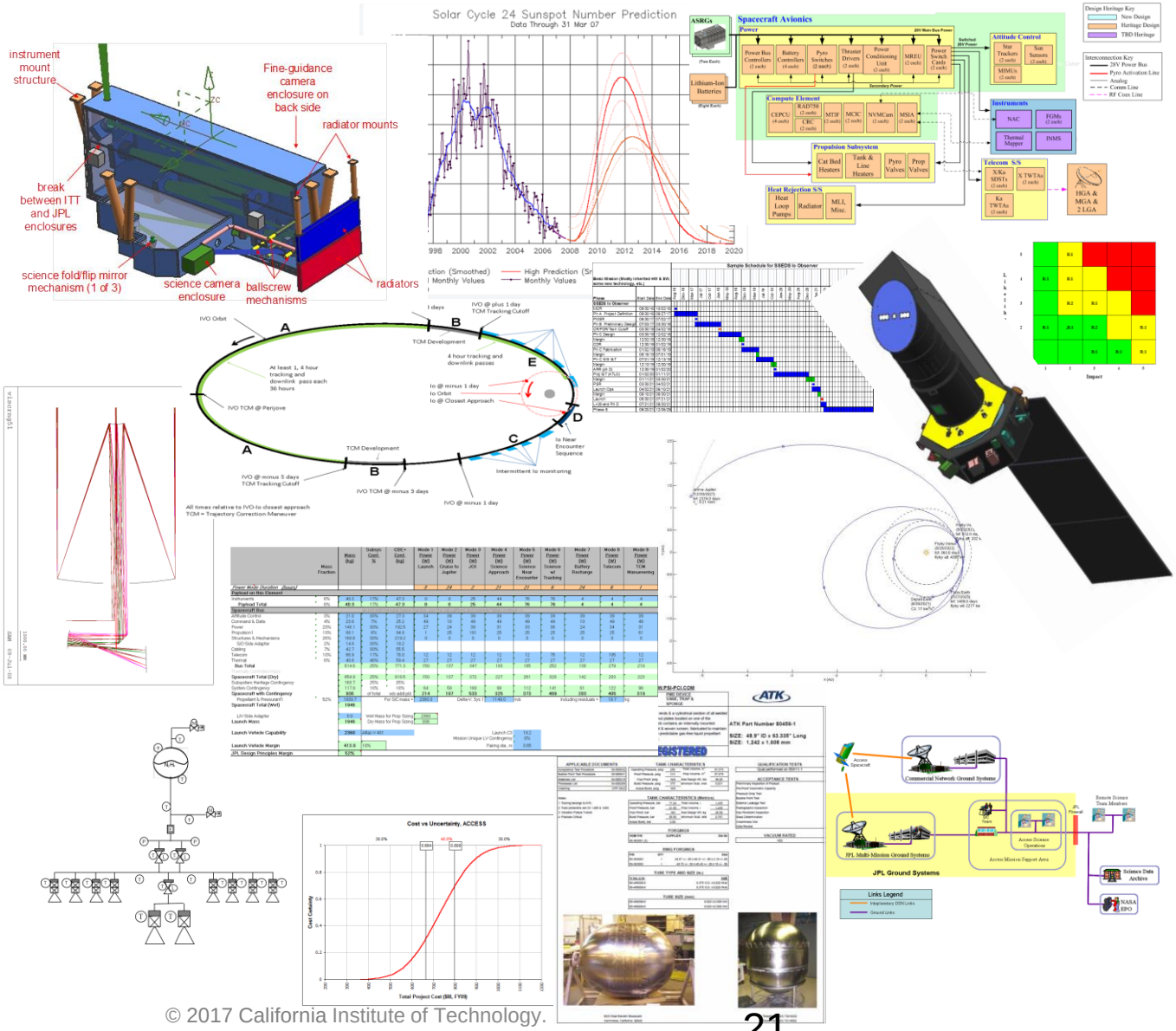


Studies by JPL Directorate



What does Team X Produce?

- Text or Powerpoint Design Descriptions
- Trajectory/Orbit Design
- Ground Track Maps
- Operations Scenarios and Timelines
- Mass/Power Estimates
- Subsystem Block Diagrams
- Parts Lists
- Heritage Descriptions
- Ground System Architecture
- Data Volume/Rate Calculations
- Link Budgets
- Radiation Analysis
- Instrument Design
- Optics Ray Tracing
- Animation
- CAD
- Thermal FEA
- Schedule Estimates
- ICM Cost Estimates
- Cost Risk S-Curves
- Risk Lists/Matrix
- Limited Trades

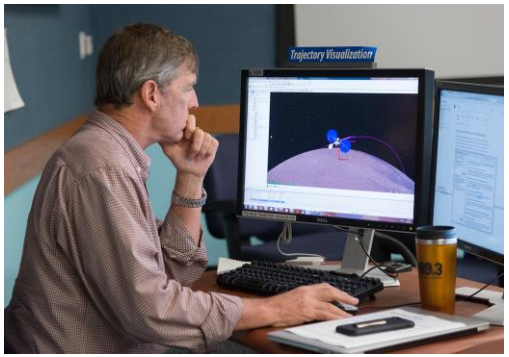


Team X Results Are Based on …

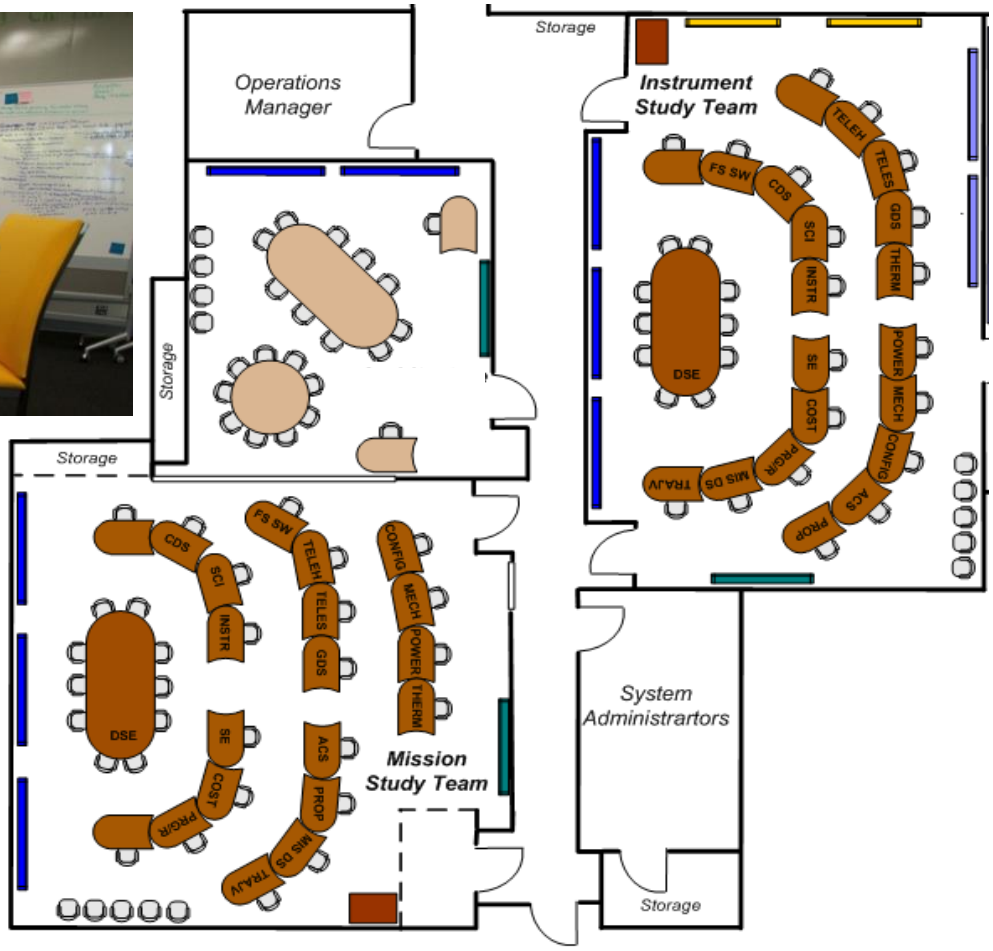
- Method
  - Stable, reliable, clear, understood, exercised
  - Tailored for each stage of the formulation lifecycle
- Access to Subject Matter Experts
  - Standout subject-matter experts (technical *and* programmatic)
  - On-demand when (but only when) needed
- Facilities
  - Optimized for pace and interactions of formulation
- Smart access to prior work
  - Thousands of engineered concepts, hundreds of vetted proposals, tens of PI-led missions already “in the can”

Team X Subject Matter Experts

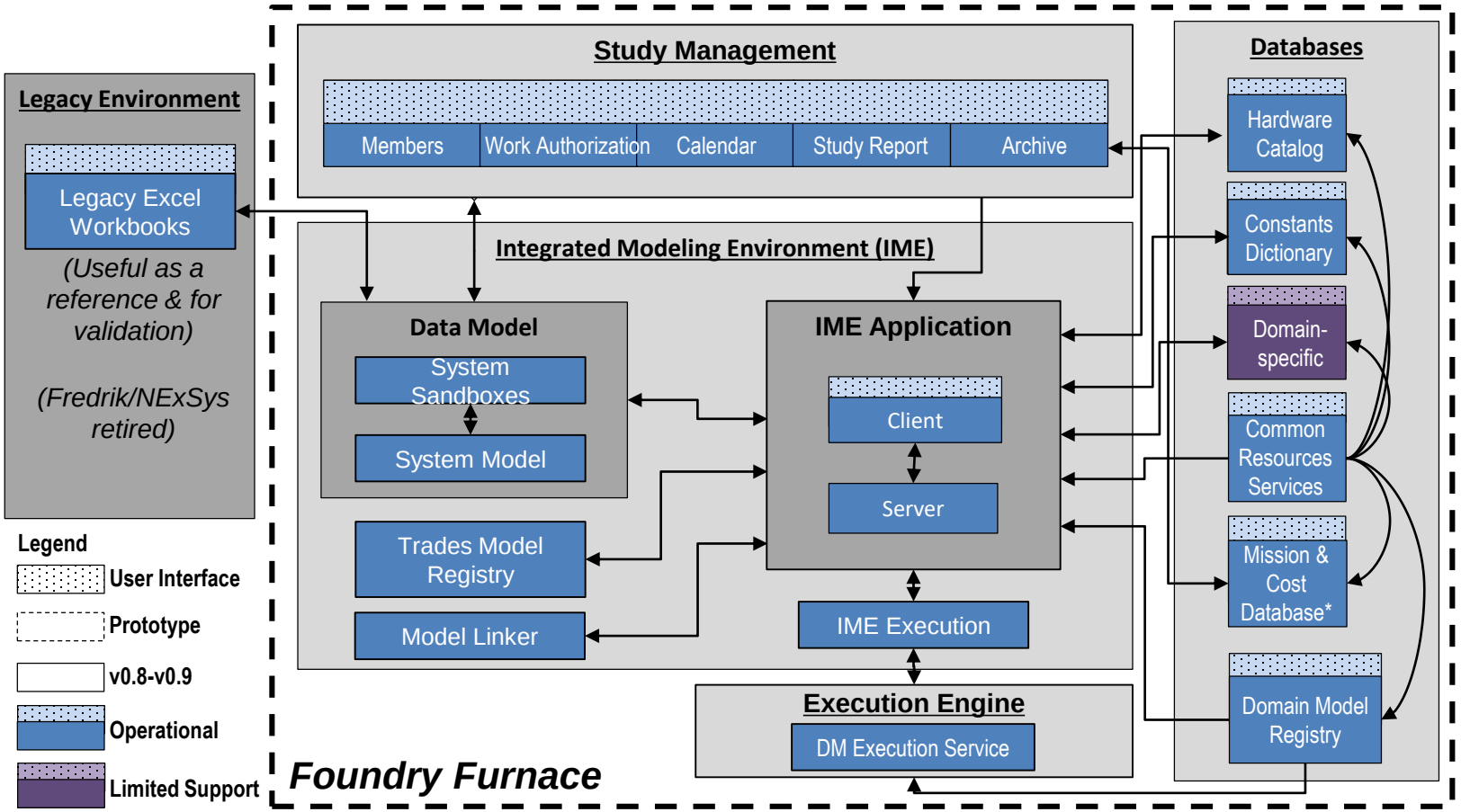
- Over 200 Team X members at JPL
- About 20 regular “SMEs”
  - Each with a lead and at least 2 backups
- Each represents major subsystems of the spacecraft design
- Represent the “doing” orgs
- Work part-time on flight projects
- Additional experts are added as needed



JPL Concurrent Engineering Facilities



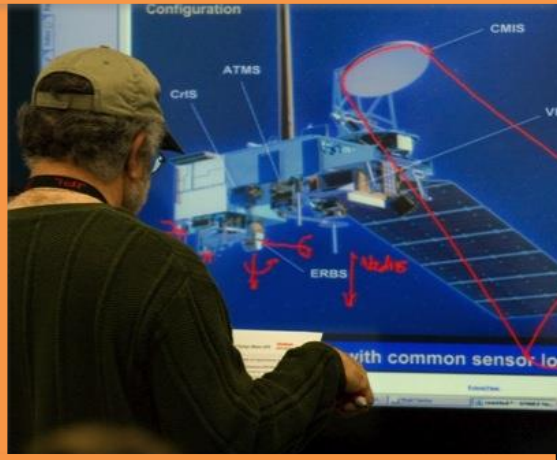
JPL Proposed IT Infrastructure for Deployment in FY18

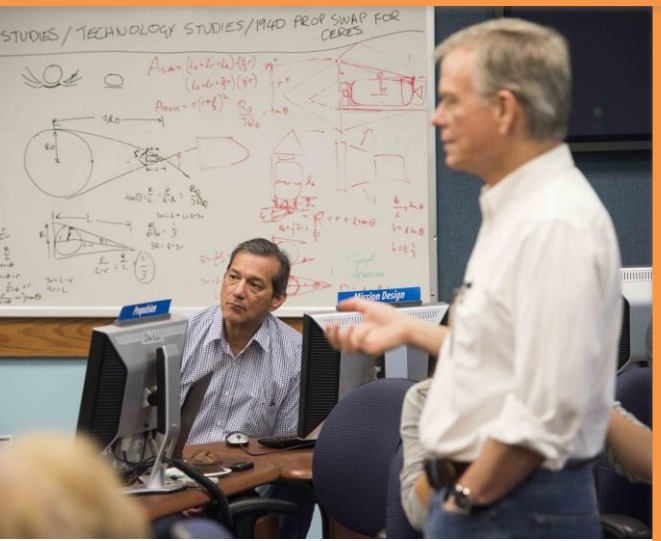



active
corpus
callosun


Concept for an outerplanet
Mass= 940KG
Pwr:MMRTG

Questions?


Configuration
CMIS
ATMS
CrIS
ERBS


STUDIES / TECHNOLOGY STUDIES/1940 PROP SWAP FOR CERES


N
Team X Operations Manager
Storage
Instrument Study Team Area C
Architecture Study Team Area B
Storage
System Administrators
Mission Study Team Area A
Storage

What is the Study Process of

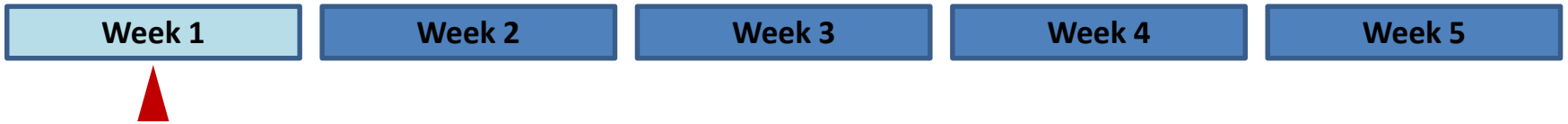
What is Concurrent Engineering?

Traditional Mission Concept Method – Serial

Concurrent Engineering Approach – Parallel

Diverse specialists working in real time, in the same place, with shared data, to yield an integrated design

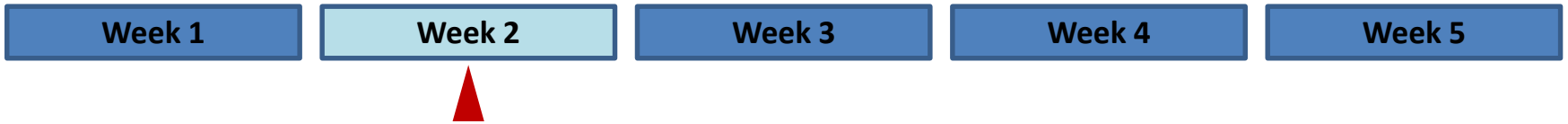
Study Timeline



Planning (1 hour)

- Understand client's goals and objectives
- Determine what they need vs. what they want
- Concept Maturity Levels (CML) are used as a "Rosetta Stone" to understand client needs
- Agree on study scope, staffing, and study cost
- Book study dates on Team X calendar

Study Timeline



Pre-Session (1 hour)

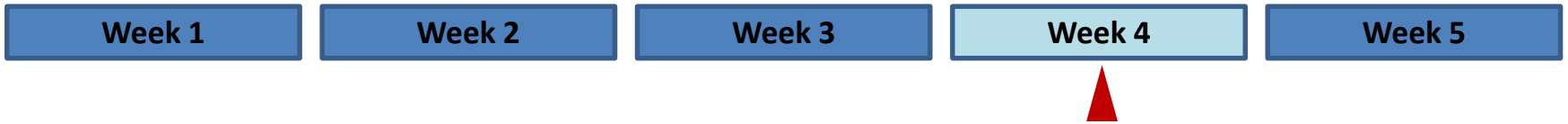
- Customer provides briefing to subsystem Subject Matter Experts
- Deliverable dates agreed upon by Study Lead and customer team
- Homework and action items assigned

Study Timeline

Design Sessions (3 hours per session)

- First Day customer provides updated briefing package to subsystem Subject Matter Experts
- Last Day Subject Matter Experts brief customer on subsystem design, risk, and cost
- Number of sessions varies depending on the study and products required
  - Typically two or three 3-hour sessions

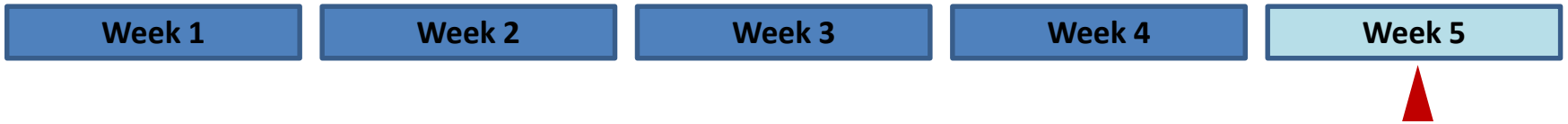
Study Timeline



Post-Session

- Subsystem input deadline
  - In-session comments: end of last session
  - Full report: ~1 week after last session

Study Timeline



Study Close-out

- System Engineer & Deputy System Engineer compile draft report
  - ~1 week after subsystem input deadline
- Send Draft report to customer team for feedback
- Optional meeting with customer team to discuss draft report

Principles of Team X

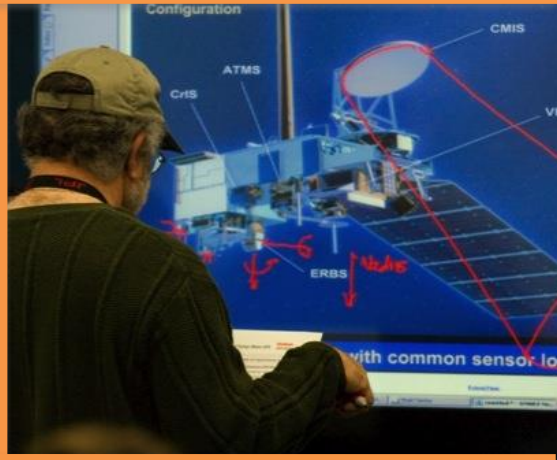
- Technical and cost models are institutionally endorsed
- Staffing is vetted by the “doing” organizations
- Team X is a room full of peers
- Customer team is part of the design process
  - Make informed design decisions based on real-time results

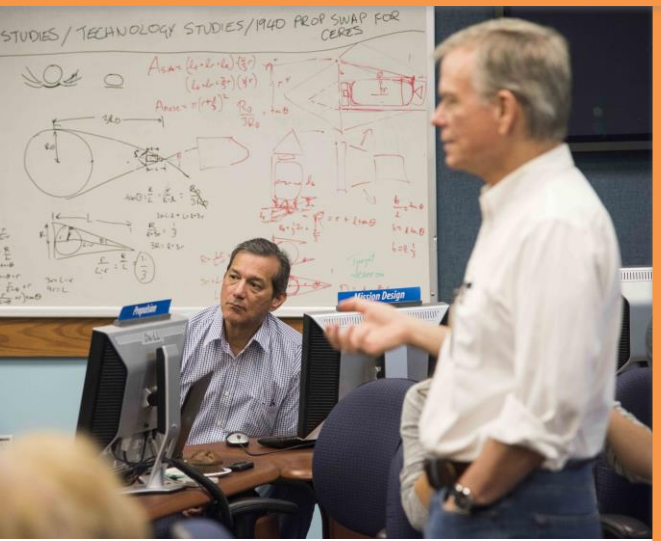
“It’s really great to see a team come together in that ***collective knowledge***.”
- Alfred Nash, Team X Lead Engineer


active
corpus
callosun


Concept for an outerplanet
Mass= 940KG
Pwr:MMRTG

Questions?


Configuration
CMIS
ATMS
CrIS
ERBS


STUDIES / TECHNOLOGY STUDIES/1940 PROP SWAP FOR CERES


N
Team X Operations Manager
Storage
Instrument Study Team Area C
Architecture Study Team Area B
Storage
System Administrators
Mission Study Team Area A
Storage